

This report provides a record of flood events and interpretive hydrologic information relating to floods on Ríos Yagüez and Guanajibo in the Mayagüez area of western Puerto Rico (fig. 1). The information contained in the report can be used to improve the basis for decisions regarding land use in the flood-prone areas shown by the map. Flood data are tabulated, areas of inundation are delineated, and water-surface profiles and contours are shown to give a record of floods that have occurred. Analyses of data are given to indicate the frequency and magnitude of floods that can be expected to occur in the future.

Floods on Río Yagüez often have inundated areas of the city of Mayagüez. The areas inundated by the floods of March 3, 1933, and July 30, 1963, are shown on the topographic base map. The 1933 flood was the greatest since at least 1899. In contrast, the 1963 flood was a moderate one although much urban area was inundated. In the area of this report Río Yagüez is crossed by five bridges, all within the city of Mayagüez. In downstream order, they are located at Calle Balboa (Highway 106), Calle Luna (Highway 108), Calle Post (Spur Highway 2), Avenida Eugenio María de Hostos (Highway 2), and Calle Concordia (Highway 102). Avenida Eugenio María de Hostos was constructed in 1961 but there were bridges at the other crossings prior to 1933.

Floods on Río Guanajibo have inundated large areas of agricultural land and many kilometers of highways. The approximate area inundated by the flood of July 30, 1963, in the study area is delineated on the map. Areas flooded by Río Guanajibo to the east and southeast of the study area are so extensive that they warrant presentation in a separate report that will be prepared at a later date.

Delineation of the areas of inundation was based on floodmarks and reflect conditions that existed at the time of the floods. Many changes have been made and are being made in the flood plains of these rivers. Continued alterations to the topography of the valleys will result in altered patterns of inundation.

Floods on Quebrada del Oro, Caño Majagual, Quebrada Sábalos, Caño Merle, Río Hondo, and Quebrada Maga can cause local inundation. Except for Caño Majagual, however, the flood data found for these streams were not adequate to permit delineation of flood limits.

Drainage basins.—Río Yagüez heads in the mountains east of Mayagüez at an elevation of about 400 meters. The average slope of the stream is about 0.025 upstream from the study area and less than 0.004 within the area. This is a change in average slope from a fall of 25 meters per kilometer to less than 4 meters per kilometer. The drainage basin is narrow, having a length-width ratio of about 10 to 1, and a total area of 13.7 square miles.

Río Guanajibo originates in the mountains at an elevation of about 800 meters, flows southward to the town of Sabana Grande and then generally westward for about 30 kilometers to the Mona Passage (fig. 1). The river is fed by a series of tributaries that also have their sources in the mountains to the north of the river. The average slopes of the tributary streams are steep, ranging from 0.026 to more than 0.08, but the average slope of Río Guanajibo from Sabana Grande to the mouth is about 0.0028. The average slope of the river in the study area is only 0.0014. The total drainage area of Río Guanajibo is 127 square miles.

Considering the different size of drainage areas, it is probable that an intense small-area storm that could cause severe flooding on Río Yagüez would not cause general flooding on Río Guana jibo.

ATLANTIC OCEAN

**EXPLANATION** 

Area of this repor

Boundary of drainage

Area flooded March 3, 1933

Area flooded July 30, 1963

Water-surface contour for

1963 flood. Contour interval 1-meter (above 2-meter line)

Boundary of 1933 flood

Boundary of 1963 flood

Area filled since 1933

EXPLANATION

0 5 10 KILOMETERS

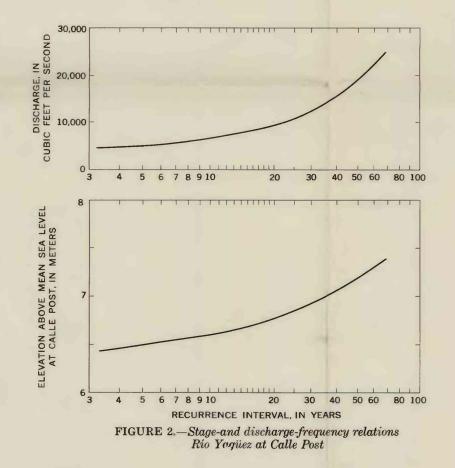
Flood occurrence.—The greatest flood known on Río Yagüez occurred on March 3, 1933. A 24-hour precipitation of 17.40 inches at Mayagüez was recorded for that date by the U.S. Weather Bureau. Floodmark data are not available for earlier floods but information from local residents indicates that the 1933 flood was the greatest since the flood of August 8, 1899, and might have been greater than the 1899 flood. Data for known floods on Río Yagüez at Calle Post are shown in the following table.

| Date of flood  | Elevation above<br>mean sea level at<br>Calle Post (meters) | Discharge<br>at Calle Post<br>(cfs) <sup>1</sup> | Recurrence<br>interval<br>(years) |
|----------------|---|--|-----------------------------------|
| Aug. 8, 1899   |   |  |                                   |
| Sept. 13, 1928 | <7.39   |  |                                   |
| Mar. 3, 1933   | 7.39  | 25,000   | 69                                |
| Dec. 3, 1960   | 6.50  | 5,000  | 5                                 |
| July 30, 1963  | 6.43  | 4,600  | 3                                 |
| Sept. 17, 1966 | 6.60  | 6,300  | 10                                |

The earliest and largest flood on Río Guanajibo for which elevation data are available occurred on September 23, 1952. Floods inundating large areas of land occurred at least four times during the period 1953-63 but no other major flood had occurred up to 1967. The discharge of floods on Río Guanajibo has nót been determined. Known flood data on Río Guanajibo at the Departamento de Hacienda bonded rum warehouse, profile kilometer 5.6, are tabulated below.

| Date of flood   | Elevation above mean sea level<br>at kilometer 5.6 (meters) |  |
|-----------------|---|--|
| Sept. 23, 1952  | 8.26  |  |
| Sept. 5-6, 1954 | 8.22  |  |
| Dec. 3-4, 1960  | 8.23  |  |
| May 17-18, 1963 | 7.96  |  |
| July 30, 1963   | 8.08  |  |

Flood frequency.——It is not possible to predict when a flood of specific magnitude will occur. However, it is possible to estimate the longtime average interval between the occurrence of floods of selected magnitudes if a sufficiently long record of floods is available. Stage- and discharge-frequency relations for Río Yagüez at Calle Post are shown in figure 2. These relations will change if the hydraulic characteristics of the valley are changed.



The time record of floods on Río Guanajibo is fragmentary and not of sufficient length to determine reliable flood-frequency relations. Flood profiles. — Flood profiles represent the

maximum elevations of the water surface for specific floods along arbitrarily chosen base lines shown on the map. The profiles are good indicators of the slope of the water surface but they often are not representative of the water surface at the boundaries of inundation except where the boundaries are close to the base line. The profiles for the floods of March 3, 1933, July 30, 1963, and September 17, 1966, on Río Yagüez are shown in figure 3. The profile for the flood of July 30, 1963, on Río Guanajibo is shown in figure 4.

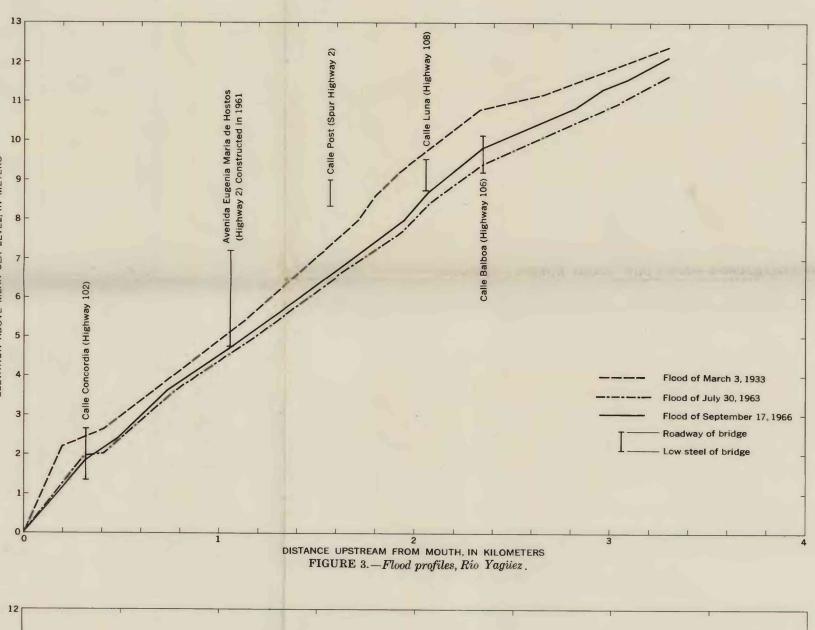
Water-surface contours.——Water-surface contours depict lines of equal elevations of water surface and they should be normal to the direction of lines of flow. During a flood the general flow lines in a narrow, unobstructed valley are about parallel to each other and to the boundaries of flow. But where the valley widens or where obstructions to flow are in the natural path of a flood, the flow lines and consequently the watersurface contours, become distorted. Water-surface contours drawn on the basis of floodmarks are good indicators of water-surface elevations in most of the inundated areas. Water-surface contours, based on floodmarks of the July 30, 1963, flood, are shown on the map.

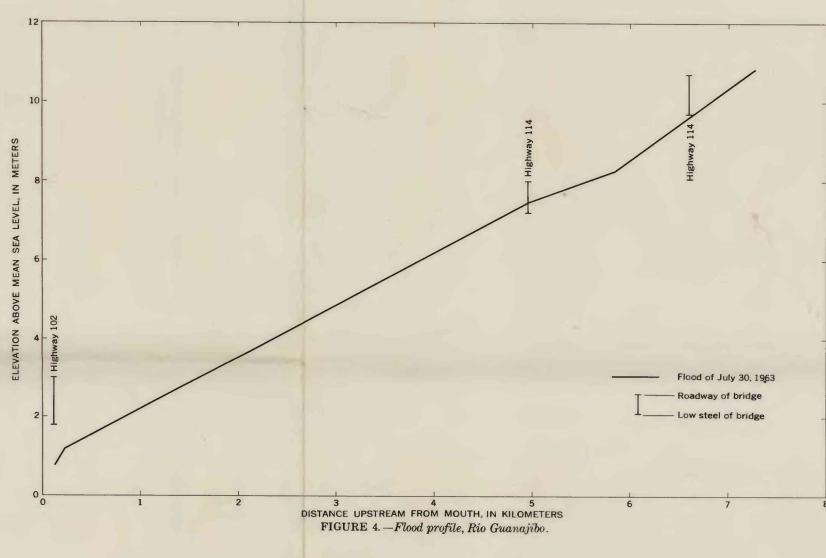
Depth of flooding.—Maximum depth of flooding can be estimated at any point in the inundated areas for the flood of July 30, 1963. This is done by subtracting the ground elevation from the water-surface elevation, shown on the map by water-surface contours. The map also shows ground contours but because of the rapidly changing topography of the area, the elevation of the ground at a selected point can be most accurately determined by running levels from a bench mark. The water-surface elevation at a selected point can be estimated by interpolation between water-surface contours.

Additional information.—Additional information relating to floods on Ríos Yagüez and Guanajibo can be obtained from the U.S. Geological Survey, San Juan, Puerto Rico, or from Sección de Control de Inundaciónes, Puerto Rico Department of Public Works, Stop 22½, Ponce de Leon Avenue, Santurce, Puerto Rico.

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FLOODS IN THE MAYAGÜEZ AREA OF PUERTO RICO